APPENDIX A

QUICK REFERENCE GUIDE

SUMMARY OF TRAP CALLS

Mnemonic	Code	Hex	Function
ERROR	-1	-1	Print ?Err?, return to Command Level
CONTC	0	0	Return to Command Level
OUTC	1	1	Output byte in reg A to screen
KBDC	2	2	Read keyboard, trap CTRL C
PUTBYT	3	3	Output byte in reg A to tape
GETBYT	4	4	Read byte from tape into reg A
LPOUT	5	5	Output byte in reg A to selected printer
OUT1	6	6	EMT via transfer vector (spare)
OUT2	7	7	As OUT1
IN1	8	8	EMT via transfer vector (spare)
IN2	9	9	As IN1
IN3	10	A	As IN1
OPNWT	11	B	Open screen in frame blanking
CLOSE	12	C	Close screen
*GRAFIX	13	D	Clear screen, 4 line scroller
*SCROLL	14	E	Full screen scroller
*CLEAR	15	F	Clear selected screen area
WAIT	16	10	Wait B 833 usec intervals
GETSYN	17	11	Get sync char in reg A from tape
UPDATE	18	12	Copy MASK to PORT0
GETHEX	19	13	Get hex number from kbd in reg HL
DEOUT	20	14	Put reg DE to (HL) in ASCII
BYTEO	21	15	Put reg A to (HL) in ASCII
*OUTC	22	16	As EMT 1 (not via transfer vector)
MSG	23	17	Output message at (HL) to screen
CHAN	24	18	Execute EMT given in reg C
INIT	25	19	Initialise disk unit
RDSEC	26	1A	Read sector
WRSEC	27	1B	Write sector
WRCHK	28	1C	Write and check sector
KBDIN	29	1D	Read and clear keyboard
KBDTC	30	1E	Test keyboard, return character
KBDTL	31	1F	Test keyboard, return -1 (true)
KBDTF	32	20	Test keyboard for CTRL F
KBDW	33	21	Wait for character from keyboard
KBDWF	34	22	As KBDW, trap CTRL F
SAVE	35	23	Save regs HL, DE and BC
SAVEA	36	24	As SAVE, also save AF
FSTLST	37	25	Access COS routine
GETJP	38	26	Return Ath entry from table at (HL)
BASE	39	27	Return scratchpad addr in reg DE
SETCAS	40	28	Set tape speed from reg A
SETLST	41	29	Set printer from regs A and E
OUTNC	42	2A	Scroller output without clearing page key
*OUTF	43	2B	Output to screen at (HL) from reg A
*INF	44	2C	Input from screen at (HL) to reg A
S4KTL	47	2F	As KBDTL, but from SIO-4

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Mnemonic	Code	Hex	Function
S4KIN	48	30	Read SIO-4 into reg A
BOOT	49	31	Perform a cold bootstrap
LPSTAT	50	32	Check that printer is ready
VERSN	51	33	Return version number of COS

* These EMTs may not be supported in future versions of COS

SUMMARY OF OUTC CONTROL CHARACTERS

Character	Code	Hex	Function
CTRL D	4	4	Resume output (after CTRL O)
CTRL H (BACKSPACE)	8	8	Cursor left (non-destructive)
CTRL I (TAB)	9	9	Horizontal tab (non-destructive)
CTRL J (LINE FEED)	10	A	Cursor down
CTRL K	11	B	Cursor up
CTRL L (FORM FEED)	12	C	Clear screen, cursor to bottom left
CTRL M (RETURN)	13	D	Carriage return/linefeed
CTRL N	14	E	Carriage return
CTRL O	15	F	Suppress output
CTRL Q	17	11	Clear paging counter
CTRL S	19	13	Set paging counter
CTRL U	21	15	Blink on
CTRL V	22	16	Initiate XY addressing
CTRL W	23	17	Blink off
CTRL X	24	18	Cursor right (non-destructive)
CTRL Y	25	19	Clear to end of line
CTRL]	29	1D	Cursor home (top left)
CTRL ↑	30	1E	Clear to end of line
CTRL _	31	1F	Cursor home and clear screen
DELT (RUBOUT)	127	7F	Destructive backspace

SUMMARY OF MONITOR COMMANDS

B	Bootstrap CP/M from disc and execute
X	Bootstrap CP/M from disc drive B
L	Load program from cassette
D	Dump memory to cassette
C	Continue program at restart address
J	Jump to address and execute program
O	Select printer option
M	Enable High Resolution Graphics board as memory
CTRL C	Return to Command Level
CTRL F	Enter Front Panel mode
CTRL T	Enter Typewriter mode

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SUMMARY OF FRONT PANEL COMMANDS

RETURN	Increment memory pointer
-	Decrement memory pointer
LINE FEED	Advance memory pointer by 8
/	Move memory pointer back by 8
CTRL L	Advance memory pointer by 32
CTRL O	Move memory pointer back by 32
M	Set memory pointer
I	Set memory pointer from memory contents (absolute)
R	Set memory pointer from memory contents (relative)
U	Set memory pointer from PC contents
.	Increment register pointer
X	Switch register display to alternate set
V	Update PC from memory pointer
G	Get first occurrence of specified pattern of bytes
N	Find next occurrence of pattern
H	Hexadecimal calculator
P	Fill and test memory between limits
S	Shift memory content
O	Set printer option
J	Jump to address and start execution
K	Continue program execution from PC
Z	Single step
<	Increment I/O port pointer
>	Decrement I/O port pointer
,	Write byte to I/O port
CTRL B	Return to monitor command level
CTRL C	Go to either command level or to CP/M if booted

LISTING OF COS WORKSPACE

This is an edited listing of the memory used by COS for the storage of transfer vectors, ports and main work variables. A full listing of the monitor is available on request.

```
FF00    NLINES: DEFS    1           ;Lines to scroll
FF01    TOP:    DEFS    2           ;Top of scrolled area
FF03    MASK:   DEFS    1           ;Port 0 Mask
FF04    VTPTR:  DEFS    2           ;VT Pointer
FF06    MPTR:   DEFS    2           ;Memory Pointer
FF08    RPTR:   DEFS    1           ;Register Pointer
FF0B    TAPESW: DEFS    1           ;Tape speed
FF0E    TABSRP: DEFS    1           ;Tab stops

        ;Transfer Vectors

FF0F    GETGAP: DEFS    3           ;Gap Vector
FF12    KBDTLV: DEFS    3           ;KBDTL Vector
FF15    KBDWFV: DEFS    3           ;KBDWF Vector
```

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```
FF18    VTV:    DEFS    3           ;Console out
FF1B    KBDV:   DEFS    3           ;Console in
FF1E    TOV:    DEFS    3           ;Tape out
FF21    TIV:    DEFS    3           ;Tape in
FF24    LPV:    DEFS    3           ;Line printer out
FF27    OUT1:   DEFS    3
FF2A    OUT2:   DEFS    3
FF2D    IN1:    DEFS    3
FF30    IN2:    DEFS    3
FF33    IN3:    DEFS    3
FF36    TRAPX:  DEFS    3           ;Trap Extension Vector
FF39    MONX:   DEFS    3           ;Monitor Extension Vector

        ;General storage

FF3C    ADDR:   DEFS    2           ;User cold start ADDR
FF3E    UMASK:  DEFS    1           ;UPORT Mask
FF3F    DLYTIM: DEFS    2           ;SIO-2/2B Rate
FF44    LSTATV: DEFS    3           ;LST status vector
FF47    CTBL:   DEFS    CTBLEN+1    ;VT control table
FF6E    INITV:  DEFS    3           ;Disc transfer vectors
FF71    RDSECV: DEFS    3           ;  initialised to 0FFH
FF74    WRSECV: DEFS    3           ;  for cassette
FF77    WRCHKV: DEFS    3
FF87    PATL:   DEFS    1           ;Length of pattern
FF88    PATN:   DEFS    1           ;Start of pattern
FFFE    .IO:    DEFS    2           ;FP Port Pointer
0006 =  HIMEM   EQU     0006H       ;PTR to top of RAM

        ;Port addresses (Memory mapped hardware)

FBFC =  KBD     EQU     0FBFCH      ;Keyboard latch (R)
FBFC =  PORT0   EQU     0FBFCH      ;System control (W)
FBFD =  CNTR    EQU     0FBFDH      ;Tape decode counter (R)
FBFE =  PORT1   EQU     0FBFEH      ;System status (R)
FBFF =  UPORT   EQU     0FBFFH      ;User I/O Port

        ;Port 0 bit allocation (W)

0007 =  PAGE    EQU     7           ;Mem page switch
0006 =  CLRCNT  EQU     6           ;Clear 8 usec counter
0005 =  RLY2    EQU     5           ;Relay 2 (=0 for closed)
0004 =  FREQ    EQU     4           ;Set 2400 Hz
0003 =  RLY1    EQU     3           ;Relay 1 (=0 for closed)
0002 =  VTOPN   EQU     2           ;Open VT memory
0001 =  SINGLE  EQU     1           ;Enable single step (0=set)
0000 =  CLRKBD  EQU     0           ;Clear keyboard latch

        ;Port 1 bit allocation (R)

0007 =  LINE    EQU     7           ;VT Line waveform
0006 =  FRAME   EQU     6           ;VT Frame waveform
0005 =  TAPE    EQU     5           ;Cassette signal sense
0003 =  VOL     EQU     3           ;Cassette volume sense
0002 =  RESET   EQU     2           ;Reset button
0001 =  CLK     EQU     1           ;1200 Hz clock
```

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APPENDIX B

CHANGES FROM VERSION 3.0

This section describes the differences between COS versions 3.4 and 3.0.

COS MONITOR COMMAND LEVEL

The M command has been added and enables the High Resolution Graphics board as memory and restarts COS. This will only function correctly on 32K systems.

The O (option) command no longer checks in disc versions for cassette speed control. It goes straight into asking for printer type. If (out of habit) L is typed, the question is typed again. There are now line printer options 5 and 6, indicating the extra serial interfaces SIO-5 and 6, which are additional SIO-4 serial interfaces.

The new X command causes COS to boot CP/M off drive B. This effectively swaps drives A and B, and C and D as far as CP/M is concerned, so all references to A: will access drive B, and vice versa.

The responce to Load and Dump is slightly changed - instead of the address appearing two spaces indented after a flashing cursor, it appears at the beginning of the line. Also, a greater than sign (>) is output after each record which is NOT loaded.

FRONT PANEL

The V command has been added and updates the program counter PC from the memory pointer.

The O command has been changed as described above.

Terminating a command with CTRL L or CTRL O increments or decrements the memory pointer by 32 respectively.

A comma no longer sends a zero to the output port specified by the I/O pointer if there were no hex characters input - instead, the comma is ignored.

VIDEO DISPLAY

The screen handler has been very extensively modified. The cursor is no longer confined to the bottom line of the screen. Instead, various control characters move the cursor round the screen. If the scroller performs an automatic carriage RETURN/LINE FEED because the 40th character has been received, it will ignore the next character if it is a carriage RETURN (or the next two if they are carriage RETURN/LINE FEED). Carriage RETURN acts as a carriage RETURN/LINE FEED, but the next character is ignored if it is a LINE FEED. This behaviour is intended to

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make sure that old programs still work while providing new software with more powerful facilities. The characters interpreted are summarised in Appendix A.

EXTERNAL VDU

COS now checks during intialisation to see if there is a VDU plugged into the SIO-4 socket. If there is, all subsequent output via the scroller output EMTs is sent to this VDU. Graphical output, such as the Front Panel, or low or high resolution graphics, still appear on the RML screen. If a character is received from the VDU at 9600 Baud, COS also switches the keyboard EMTs to take all subsequent input from the VDU ignoring the RML keyboard.

CASSETTE SUPPORT

Slow (300 Baud) cassette support is no longer provided on disc versions, and all cassette I/O in these cases is consequently at 1200 Baud. Appendix C describes a separate utility program which is available to provide slow speeds.

EMT SUPPORT

The EMT and CALR mechanisms have been speeded considerably. This means that certain processes occur rather more quickly than in earlier versions. The minimum execution time for an EMT is now about 65us rather than 125us in earlier versions.

EMTs SETTAB and VERIFY no longer exist, and return immediately to the calling program with registers intact.

On disc versions, EMT SETCAS now simply returns 3, indicating fast input and output, because of the removal of the slow cassette option.

EMT BOOT (code 49 decimal, 31 hex) has been added. This causes CP/M to perform a cold bootstrap, on drive A or B depending on whether the last cold boot was by B or X from command level.

EMT LPSTAT (code 50 decimal, 32 hex) returns A=0 and the zero flag set if the printer device last selected by EMT SETLST is busy, otherwise -1 and non-zero.

EMT VERSN (code 51 decimal, 33 hex) returns the version number of COS in A.

The disc EMTs now go via transfer vectors allowing switching between types of disc.

The EMTs KBDTL, KBDWF and LSTAT also now go via transfer vectors allowing alternative handlers to be installed as required.

APPENDIX C

SLOW CASSETTE SUPPORT

Disc versions of COS 3.4 do not support slow cassette loading and saving at 300 Baud. This means that cassette I/O can only occur at 1200 Baud. A utility program entitled SCASS is available which changes the cassette I/O transfer vectors in COS workspace in order to provide slow cassette transfer rates.

When SCASS is loaded into memory at 100 hex, it relocates itself to high memory and links itself into the cassette transfer vectors. In a cassette system, the I/O handlers themselves run at the top of memory, and the memory location HIMEM is modified to take this into account. On disc systems, the handlers reside in the workspace at FC00 hex. This means that SCASS on disc cannot be run in conjunction with such programs as ADM3A.

Once the slow handlers have been loaded, they continue to be effective until the Reset button is pressed. Until this time, all cassette I/O is at 300 Baud, i.e. it is always slow.

NOTE: The cassette version of SCASS should always be used for cassette software, e.g. BASIC, TXED, etc. The disc version should be used in conjunction with disc software, e.g. BASLOAD, FILEX, etc. SCASS will crash if the wrong version is used.

In disc systems, SCASS should be loaded as follows:

```
A>SCASS


A>CTRL F      (echoed as ¢F)
!CTRL B       (echoed as ¢B)
-
```

Now in Monitor command level, cassette I/O can take place. It should be noted that since SCASS runs from 100 hex, programs to be dumped to cassette should be loaded into memory AFTER SCASS.

In cassette systems, simply use the L command to load SCASS. Again for dumping programs to cassette, they must be stored after SCASS.

```
-L
Name>SCASS
```

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